Time.	Volts.		Remarks.
P. M.	*Plus.*	*Minus.*	
4.17 00	2400		Thunder heard.
4.18 00	600		
4.19 00	2000		
4.19 10	1500	1200	
4.19 30	00		Thunder heard.
4.20 00		900	
4.21 00	1800		
4.23 00	3900		
4.24 00	2400		Rain diminishing.
4.24 15	2100	2700	
4.24 30			Thunder heard.
4.25 00	2700		
4.26 00	300		
4.27 00		300	Raining hard.
4.28 00		1080	
4.29 00		750	Clearing.
4.30 00	1500		
4.31 00	300		Rain ended.
4.32 00		450	
4.33 00	210		

OPTICAL PHENOMENA.

SOLAR HALOS.

Solar halos were observed in the various states and territories, as follows:

Alabama.—Mobile, 2d.

Arizona.—Yuma, 5th, 28th; Prescott, 28th.

California.—San Diego, 1st, 6th, 8th, 11th, 28th.

Colorado.—Montrose, 22d.

Florida.—Archer, 1st, 31st; Key West, 26th, 28th.

Georgia.—Savannah, 29th, 31st.

Illinois.—Pekin, 1st, 23d, 29th; Riley, 3d, 6th, 9th, 19th.

Indiana.—Indianapolis, 3d; Vevay, 5th, 21st.

Iowa.—Corydon, 9th; Cedar Rapids, 18th.

Kansas.—Manhattan, 5th, 17th; Yates Centre, 8th, 20th; Wyandotte, 23d, 24th, 26th, 29th, 30th, 31st.

Maine.—Orono, 16th.

Massachusetts.—Blue Hill Observatory, 4th; Provincetown, 16th.

Michigan.—Port Huron, 1st, 20th; Grand Haven, 11th.

Nebraska.—Omaha, 8th.

New Jersey.—Dover, 12th; Clayton, 13th, 24th.

New York.—Oswego, 4th, 5th.

North Carolina.—New River Inlet, 27th, 30th.

Ohio.—Wauseon, 11th, 19th, 20th, 21st.

Pennsylvania.—Erie, 9th; East Brook, 22d.

South Carolina.—Stateburg, 6th, 8th, 11th, 24th; Spartanburg, 31st.

Tennessee.—Nashville, 16th, 17th.

Texas.—Galveston, 2d.

Vermont.—Strafford, 16th.

Virginia.—Variety Mills, 3d, 6th, 24th; Dale Enterprise, 3d, 11th, 21st; Lynchburg, 17th, 19th, 20th, 25th; Rappahannock Station, 21st.

Wyoming.—Fort Bridger, 2d, 30th.

LUNAR HALOS.

Lunar halos were observed in the various states and territories, as follows:

Arizona.—Yuma, 4th, 10th, 11th, 12th.

California.—Sacramento, 17th.

Connecticut.—New Haven, 11th, 17th.

District of Columbia.—Washington City, 7th, 9th, 11th.

Florida.—Archer, 5th, 8th, 9th, 14th, 15th; Jacksonville, 8th, 15th; Key West, 10th, 15th; Limona, 13th; Manatee, 12th, 14th.

Georgia.—Augusta, 6th, 24th; Savannah, 15th.

Illinois.—Pekin, 5th, 9th, 11th, 20th; Riley, 8th, 18th.

Indiana.—Lafayette, 9th.

Iowa.—Independence, 5th, 15th; Cedar Rapids, 19th.

Kansas.—Dodge City and Yates Centre, 8th; Allison and Westmoreland, 10th; Independence, 11th; Wyandotte, 20th.

Kentucky.—Louisville, 10th; Frankfort, 12th, 16th.

Maryland.—Baltimore, 12th.

Michigan.—Lansing, 8th.

Nebraska.—De Soto, 8th, 15th.

New Hampshire.—Nashua, 14th.

New Jersey.—Beverly and Egg Harbor City, 11th; Moorestown, 13th.

New Mexico.—Fort Stanton, 6th, 11th.

New York.—Setauket, 6th, 13th; Ithaca, 9th.

North Carolina.—New River Inlet, 13th; Fort Macon, 17th.

Ohio.—Elyria, 4th; Columbus, 12th to 15th; Napoleon, 13th.

Pennsylvania.—Catawissa, 13th; Pittsburg, 20th.

South Carolina.—Stateburg, 8th, 13th; Spartanburg, 10th, 12th, 14th, 17th, 18th.

Tennessee.—Nashville, 12th, 13th; Chattanooga, 18th; Ashwood, 19th.

Texas.—Cleburne, 3d; Palestine, 5th, 10th; Brownsville and Rio Grande City, 10th.

Virginia.—Dale Enterprise, 7th, 10th, 11th, 20th; Rappahannock Station, 9th to 13th, 15th; Bird's Nest, 9th, 12th, 13th, 15th, 17th; Cape Henry, 13th.

Washington Territory.—Neah Bay, 7th; Tatoosh Island, 8th.

West Virginia.—Parkersburg, 12th.

Wisconsin.—Milwaukee, 12th; Manitowoc, 15th.

Wyoming.—Fort Bridger, 7th.

The phases of the moon (Washington mean time) during August, as given in "The American Ephemeris and Nautical Almanac" for 1886, are as follows: New moon, 28th, 19 h. 46.1 m.; first quarter, 6th, 3 h. 58.0 m.; full moon, 14th, 1 h. 16.0 m.; last quarter, 22d, 2 h. 33.6 m.; apogee, 14th, 20.6 h.; perigee, 28th, 19.9 h.

MIRAGE.

Nicolaus, Sutter county, California: a mirage occurred here on the 9th, distant houses being plainly seen elevated above their usual position.

The following is from the "New York Herald" of August 14, 1886:

The phenomenon known as mirage was witnessed at 7 a. m. of the 12th at Rondout, New York. In the foreground cattle were seen lazily chewing their fodder, while close by were the farmer's house, barn, and other out-buildings. In the background the picture of a pretty rural scene was presented to the eye. The atmosphere was murky. The spectacle, which was viewed by a number of well known citizens, is said to have been the first of the kind seen in Ulster county within the memory of the oldest inhabitant.

Mirage was observed at other stations, as follows:

Webster, Dakota, 17th, 20th, 21st, 30th, 31st.

Salina, Kansas, 22d, 24th, 26th.

Egg Harbor City, New Jersey, 24th.

MISCELLANEOUS PHENOMENA.

DROUGHT.

Lead Hill, Boone county, Arkansas: very warm weather prevailed from the 12th to the 18th, with dry wind from the southwest, which, combined with the drought, was very damaging to vegetation.

Keokuk, Iowa, 31st: the corn crop on uplands is almost ruined by the drought, although copious rains fell from the 11th to the 18th. These rains were of benefit only to corn that had been planted late in bottom lands.

Fort Sill, Indian Territory: on the afternoon of the 19th a thunder-storm and heavy rain set in. This was the second heavy rain since the beginning of the drought, April 26th, and the prospects for cattle grazing were somewhat brightened. During this storm 1.53 inches of rain fell.

Mackinaw City, Michigan: heavy rain fell on the 21st and 22d, breaking the drought that had continued since the middle of June. Owing to the drought the hay and grain crops have been seriously injured, and mills using water as a power were obliged to cease operations early in July on account of the low water in streams.

Milwaukee, Wisconsin: on the 21st the severe drought which

had prevailed over this state during the past sixty days was broken in this section, and over the state generally, by a heavy rain which began at 3.50 p.m. and continued until after midnight. The damage done by the drought is very great throughout the state. The crops of hay, oats, corn, potatoes, and wheat are far below the average. Owing to the dry weather severe forest fires prevailed for several weeks in the northern part of the state, doing great damage to farms, timber property, and cranberry marshes. Several villages were partly destroyed by the fires, and others damaged. A large number of farm houses and saw mills were burned.

Lansing, Michigan: heavy rain fell on the 21st, 1.12 inches, and on the 28th and 29th, 3.45 inches. As a result of the long drought which existed previous to these rains, pastures in this vicinity are dry and farmers are obliged to feed their cattle with hay.

Liberty Hill, Bienville parish, Louisiana: drought has prevailed here from the 27th of July until the 25th of August, and will decrease the yield of cotton.

Mexico, Audrain county, Missouri: the first rain since June 26th fell on the afternoon of the 12th. The rain was of great benefit to farmers, whose crops were suffering from drought.

Dallas, Texas, 27th: Stevens, Shackelford, Young, Palo, Pento, Throckmorton, Eastland, and Baylor counties are still suffering from drought. Some parts of these counties are entirely denuded of grass, and cattle are dying in large numbers.

Thornville, Lapeer county, Michigan: although several light rains fell during the month, the drought was not broken until the night of the 29–30th when 1.20 inches fell.

J. W. Sanborn, Secretary of the "State Board of Agriculture" for Missouri, makes the following report in reference to the drought:

> Corn has gone steadily down for August, and its general condition is now sixty-one per cent. Drought and heat have been general over the state, and the few short rains were inadequate to break it. The crop is now made and will not materially change. All other crops and pastures have suffered from drought.

Abilene, Texas, 31st: the drought in this section is over; copious rains have fallen during the month in the surrounding country, with a few showers at this place.

Lawrence, Douglas county, Kansas: the July drought was broken on the 1st by a copious shower. There were seven other serviceable rains during the month, but no rain sufficiently heavy to wet the ground to a greater depth than two inches.

The observer at Topeka, Kansas, reports, concerning the drought, as follows:

> August has been a very warm month in Topeka. Such long continued warm weather has not occurred during the past eight years. When this is considered with reference to the hot July it is not surprising that the effects of the drought are severe. Corn in many fields, especially the late planted, is worth little except for fodder. Likewise all crops that depend upon July and August weather for maturing have suffered severely. The rains of August would have sufficed for the crops had July left us better prepared or had the heat and hot winds been less intense. Western Kansas has, contrary to common experience, been comparatively more favored with rain than the eastern part of the state.

EARTHQUAKES.

Report on the Charleston Earthquake.

[By Prof. T. C. MENDENHALL, Assistant.]

The earthquake of August 31st, which, from the locality in which its greatest power was displayed, will generally be known as the "Charleston Earthquake," was, perhaps, the most notable disturbance occurring within the limits of the United States of which we have any knowledge. It is entitled to this rank both on account of the wide area over which it was distinctly felt, and of the magnitude of the disaster which it caused in the immediate vicinity of the point of maximum intensity.

The earthquake consisted of a series of seismic disturbances which began in slight but distinctly noticeable tremors occurring on August 27th and 28th, at the town of Summerville, about twenty-five miles northwest of Charleston, South Carolina.

The shock of greatest violence occurred a little before ten o'clock on the night of Tuesday, August 31st. It was followed by several of lesser magnitude on that night, and during the succeeding three or four weeks. The great shock began in the city of Charleston within a few seconds of 9.51 *p. m.*, 75th meridian time. The duration of the vibratory motion of the earth at that point was probably about forty seconds; the motion at first being moderate, but increasing with great rapidity during the last ten or fifteen seconds.

All of the loss of life and property during the whole series of disturbances is to be attributed to this first shock. Five minutes later another occurred, and ten minutes later still another; the latter being of considerable violence, but neither alone would have done any damage. The same may be affirmed of the succeeding series of disturbances which, with greatly diminished intensity and at increasing intervals of time, continued to maintain the conditions of alarm and terror into which the people of the afflicted locality were naturally thrown by the first disturbance. Although some injury to buildings resulted from these after shocks, it is tolerably certain that in all such cases displacement and fracture had taken place in the great shock; the lesser disturbances simply finishing what had then been nearly completed.

The origin of the disturbances appears to have been somewhere below a point fifteen or twenty miles northwest of Charleston; that is, in the neighborhood of the town of Summerville. A chart of provisional co-seismal lines drawn by Mr. Hayden of the Geological Survey, and published in "Science" for September 10th, seems to locate this centre somewhat further north than the point indicated above. At the time of its construction, however, information from many points was lacking, and that which was at hand was admitedly doubtful in some degree.

Reference will be made later to the iso-seismal chart accompanying this report, which indicates that the origin was near the point referred to above. Strong proof of this is also furnished in the intensity and character of the disturbance as shown by the effects which were still visible when an examination was made a few days after the principal shock. The appearance of brick piers upon which many houses in Summerville rest was such as to justify the conclusion that the principal component of the motion at that point was vertical, and it was evident that the destruction of buildings was much less than would have resulted from a horizontal movement equal to that which had taken place in Charleston and elsewhere in the neighborhood.

Another fact of importance is that in the vicinity of Summerville the disturbances preceding that of August 31st took place, and here they have been most numerous and most persistent. Indeed, at the present writing, nearly a month after the first perceptible shock, they still occur at irregular intervals varying from a few hours to a few days. Only the most violent of these have been felt as far as Charleston.

Nearly all the movements in Summerville and vicinity have been accompanied by, and, indeed, generally preceded by, a low rumbling sound, lasting one or two seconds, and not infrequently this sound, always unmistakable in its character, was neither accompanied nor followed by a perceptible movement. This was a common occurrence at Summerville and in the immediate vicinity, and it was found that among several observers there would be no agreement upon the direction from which the sound appeared to come.

At a distance from ten to fifteen miles from Charleston in the direction of Summerville some of the most curious and interesting effects of the disturbance were to be seen. These were the "sand craters" and crevices, out of which extensive eruptions of sand and water had taken place on the night of August 31st. The craters thus formed varied in size from an irregular oval, twenty-five feet long by fifteen feet wide, to shallow cones not over an inch in diameter and beautifully symmetrical in form. The area surrounding these openings was generally flooded with sand, often acres in extent, to a